

Response to the PCT Written Opinion

(1) The following opinions were expressed in the Response dated January 25, 2005 issued by the PCT International Searching Authority stating that the invention of claims 1 to 10 lack inventive step based on

Documents 1 to 3. The cited Documents are as follows.

Document 1: WO 96/39357 A1

Document 2: JP 2003-519074 A

Document 3: JP 2001-233615 A

(2) Grounds for the present invention lacking inventive step are as follows.

(Regarding claims 1 to 4)

1) Document 1 describes a partial crystalline mesoporous material having regularly arranged mesopores, and having a specific surface area in the range of 300 to 1200m²/g. The three-dimensional structure of pores can be suitably adjusted based on the selection and manufacturing conditions of materials such as block macromolecule, interface activating agent and the like.

2) Document 2 describes a partial crystalline mesoporous material having regularly arranged mesopores, and having a specific surface area in the range of 130 to 170m²/g.

3) Document 3 describes a mesoporous TiO₂ thin film having regularly arranged mesopores wherein the thin film has TiO₂ crystals in the framework, and the pore structure is a hexagonal or cubic three-dimensional structure. The specific surface area can be suitably adjusted based on the selection and manufacturing conditions of materials such as block macromolecule, interface activating agent and the like.

(Regarding claims 5 to 10)

4) Document 1 describes a manufacturing method of a partial crystalline mesoporous material comprising the steps of: using an

interface activating agent as a template, and subjecting the aqueous solution or alcohol solution of titanium alkoxide or zirconium alkoxide and silicon alkoxide to hydrolysis, raising the temperature to 400 to 650°C at a speed of 2°C/minute, and performing heat treatment for 4 to 6 hours.

5 6 hours.

5) The use of hydrochloric acid as the catalyst in the hydrolysis process of the sol-gel method is well known. Manufacturing technology of a thin film supplying a sol solution in drops on a rapidly rotating substrate and performing gelation is well known. Inclusion of components such as Fe and W is described in Document 1. The use of a mesoporous material in a catalyst device is well known.

10 (3) Nevertheless, the present invention is not disclosed in the conventional technology described in Documents 1 to 3 above, and is superior technology that possesses inventive step. Incidentally, the Examiner has indicated that claims 11 to 25 possess novelty and inventive step, and arguments regarding such claims are omitted. Further, claim 25 has been deleted since there was an inappropriate description and the subject matter thereof overlapped with the other claims.

20 In order to facilitate the comparison with the cited Documents, independent claims 1, 2, 5 and 6 of the present invention are cited below. Incidentally, the scope of these claims has been limited based on the amendments dated the same day.

[1] A nanocrystal oxide—glass composite mesoporous powder or thin film having a three-dimensional structure with regularly arranged mesopores and in which a glass phase contains P_2O_5 .

[2] A nanocrystal oxide—glass composite mesoporous powder or thin film having a hexagonal or cubic three-dimensional structure and in which a glass phase contains P_2O_5 .

30 [5] A manufacturing method of nanocrystal oxide—glass composite

mesoporous powder, comprising the steps of: using a block macromolecule or interface activating agent as a template, and adding hydrochloric acid (HCl) to an aqueous solution of metal alkoxide, metal chloride or $\text{PO}(\text{OC}_2\text{H}_5)_3$ or a solution obtained by dissolving these in alcohol such as ethanol; manufacturing powder having a glass phase metal oxide—inorganic oxide composite mesostructure with a sol-gel process; maturing and gelling this between room temperature and 90°C ; removing the block macromolecule or interface activating agent by performing heat treatment thereto in the atmosphere at 350 to 400°C and manufacturing a glass phase metal oxide glass phase composite mesoporous powder; and additionally performing heat treatment thereto at 400 to 700°C so as to change the phase of the glass phase metal oxide into crystallite.

[6] A manufacturing method of nanocrystal oxide—glass composite mesoporous thin film, comprising the steps of: using a block macromolecule or interface activating agent as a template, adding hydrochloric acid (HCl) to an aqueous solution of metal alkoxide, metal chloride or $\text{PO}(\text{OC}_2\text{H}_5)_3$ or a solution obtained by dissolving these in alcohol such as ethanol, and obtaining a sol solution by performing hydrolysis while adjusting the pH; forming a thin film having a glass phase metal oxide—inorganic oxide—block macromolecule (or interface activating agent) composite mesostructure on a substrate by delivering the sol solution in drops onto a substrate, rapidly rotating the substrate, and evaporating and gelling the solvent; maturing and gelling this between room temperature and 90°C ; removing the block macromolecule or interface activating agent by performing heat treatment thereto in the atmosphere at 350 to 400°C and manufacturing a glass phase metal oxide—glass phase composite mesoporous thin film; and additionally performing heat treatment thereto at 400 to 700°C so as to change the phase of the glass phase metal oxide into

crystallite.

(4) As evident from the configuration of the claims described above, the invention of claims 1 and 2 relates to a "nanocrystal oxide—glass composite mesoporous powder or thin film wherein a glass phase contains P_2O_5 ", and claims 5 and 6 relates to the "manufacturing method of a nanocrystal oxide—glass composite mesoporous thin film" using an "aqueous solution of $PO(OC_2H_5)_3$ or a solution obtained by dissolving this in alcohol such as ethanol", and this ultimately relates to technology for manufacturing a "nanocrystal oxide—glass composite mesoporous thin film wherein a glass phase contains P_2O_5 ".

In addition, as described in paragraph [0028] of the Description, "As a result of using P_2O_5 , which is a stable glass phase even in a high temperature, the crystallite TiO_2 will not grow into a particulate TiO_2 large enough to destroy the framework, and, by a 3 to 6nm order uniform TiO_2 remaining in the framework, a nanocrystalline TiO_2 —glass P_2O_5 composite mesoporous powder having a uniform size was obtained", the significant effect of P_2O_5 as the glass phase is explained. In other words, the existence of P_2O_5 as the glass phase is plays an extremely important role in manufacturing a nanocrystalline TiO_2 —glass P_2O_5 composite mesoporous powder or thin film having a uniform size.

Further, the expression of " P_2O_5 as the glass phase" can be found throughout the Description, and it is easy to understand that this is the core and material requirement of the present invention.

(5) Next, the present invention and cited Documents 1 to 3 are compared.

1) Upon reviewing the technical content described in Documents 1 to 3, although Document 1 describes a "partial crystalline mesoporous material having regularly arranged mesopores", Si is selectively chosen to be added as the vitreous component, and the manufacturing method is merely indicated. Further, although Document 2 describes a "partial

crystalline mesoporous material having regularly arranged mesopores", it merely describes that, as the mesostructure material, silica, aluminum silicate or aluminum-type amorphous or paracrystalline inorganic matrix is used (refer to paragraph [0021] of Document 2). Moreover, Document 3 merely describes a "mesoporous TiO_2 thin film having regularly arranged mesopores wherein the thin film has TiO_2 crystals in the framework, and the pore structure is a hexagonal or cubic three-dimensional structure".

2) As evident from the above, Documents 1 to 3 do not in any way describe technology relating to a "nanocrystal oxide—glass composite mesoporous powder or thin film wherein the glass phase contains P_2O_5 " or the superior characteristics yielded thereby.

Accordingly, there is a significant difference between the present invention and Documents 1 to 3, and it would be erroneous to indicate that the present invention could have been easily devised based on the combination of Documents 1 to 3.

3) In the foregoing explanation, although the invention of claims 1, 2, 5 and 6 was compared with Documents 1 to 3 to clarify that the present invention could not have been easily devised from Documents 1 to 3, since the remaining claims are all dependent on each of the foregoing claims, such dependant claims also possess the novelty and inventive step of the present invention.

(6) Accordingly, all Documents cited in the PCT Opinion are significantly different from the present invention, and it is not possible to easily achieve the present invention based on each or the combination of Documents 1 to 3.

Therefore, it is clear that the present invention possesses patentability, and Applicant hereby requests the reexamination of the present application.